

# Ginger (*Zingiber officinale*): A Mini review

## Abstract

Ginger (*Zingiber officinale*) is used as a culinary spice as well as for medicinal purpose for centuries. Ginger tea is traditionally used for a cough and sore throat. Many types of research are done to prove these traditional uses of ginger. In this review, its chemical constituents and effects of various constituents in combating various health disorders, traditional uses, and different pharmacological activities as antimicrobial, anti-carcinogenic, anti-ulcer and as fertility enhancer are briefly discussed. By further researches on the action of ginger in these fields, ginger can be used as an effective therapeutic tool in these diseases and thus we can get a cheap, safe and effective medicinal agent for multipurpose.

**Keywords:** *Zingiber officinale*, Chemical Constituents, Pharmacological properties, Antimutagenic

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## Introduction

Ginger is traditionally useful for the treatment of gastrointestinal tract (G.I.T) disorders, but it also shows antimutagenic effects, antimicrobial effects and can be used as a fertility enhancer. *In vitro* studies indicate that ginger extract inhibits the growth of *Helicobacter pylori*, thus suggesting its use in G.I.T disorders.<sup>1</sup> Moreover, many *in vivo* and randomized control studies indicate about the effectiveness of ginger in nausea and vomiting. Ginger shows antimutagenic effects through several mechanisms in different organs. *In vitro* study, suggest that it causes anti-mutagenic effects through angiogenesis inhibition. But the data about exact mechanism by which ginger act to reduce cancer proliferation or angiogenesis is insufficient. However; *in vitro* studies of<sup>2</sup> shows that ginger extract and 6- Gingerol inhibit the colon cancer directly and indirectly by blocking the delivery of angiogenic signals to endothelial cells that supply blood to colon cancer cells. Along with ginger extract, ginger essential oil effects on mutagens were also seen and it is found that ginger essential oil inhibit mutagenicity that is induced by different direct-acting mutagens in concentration dependent manner. *In vitro* studies of ginger on different ovarian cancer cell lines suggest that ginger and ginger component effects are cell type specific. However, to use ginger as a therapeutic tool in this disease requires an *in vivo* study.<sup>3</sup> Ethanolic extract of ginger powder has showed marked inhibitory effects on *Candida albicans* on *in vitro* study.<sup>4</sup> *In vitro* study of red ginger has reflected the antibiotic effects against mastitis causing bacteria in a dose-dependent manner.<sup>5</sup> Ginger has a beneficial effect on male reproductive functions. Animal studies suggest its use as a fertility enhancer.

## Botanical description

*Zingiber officinale* commonly called ginger belongs to the family Zingiberaceae. The plants of Zingiberaceae family have tuberous or non-tuberous rhizomes, which has their particular aroma and possess different medicinal properties.<sup>4</sup> In the traditional medicine, gnarly, thick underground stem (rhizome) of ginger is commonly used.

## Chemical composition

The active constituents in Ginger root include essential oils, phenols, oleoresins, proteolytic enzymes and some others as vitamins and minerals. Among the essential oils, zingiberene, zingiberole,

camphene, Cineole, bisabolene, phellandrene, citral, borneol, citronellol, geraniol, linalool, limonene and camphene are important constituents of ginger. Phenols include gingerol and zingerone while gingerol and shogaol included among oleoresins. Other active constituents are mucilages, proteins, vitamin B6, vitamin C, calcium magnesium, phosphorus, potassium, sulfur and linoleic acid.<sup>5</sup> There are more than 50 active constituents present in ginger, and these active constituents exhibit different physiological actions. Among these, 6-gingerol considered to be a major pharmacologically active compound against colon cancer cells while shogaol and 6- paradol also play a role. *In vitro* studies shows that ginger extract and 6- gingerol inhibit colon cancer proliferation thus indicate that ginger constituents have chemotherapeutic effects.<sup>2</sup> Studies on the animal model show that red ginger extract inhibit the three prominent mastitis causing bacteria thus showing its antibiotic activity. Bisabolene, farnesene and sesquiphellandrene that were terpenes in the ginger's essential oil involved in the disruption of cytoplasmic membrane and coagulation of cell contents. Extract effect the bacterial cytoplasmic membrane and induced the loss of nucleic acid and ions thus causing antibiotic affects.<sup>5</sup> The ginger essential oil contains sesquiterpene hydrocarbons including  $\alpha$ -zingiberene (31.08%),  $\alpha$ -curcumene (15.4%), and  $\alpha$ -sesquiphellandrene (14.02%). *In vivo* studies shows that ginger essential oil possess antimutagenic activity.<sup>7</sup> *In vitro* studies of<sup>9</sup> showed that 6-shogaol inhibit the ovarian cancer cell growth.

## Traditional uses

Ginger is used in Ayurvedic and herbal medicine for a long period. It is useful in the treatment of nausea & vomiting mainly motion sickness and hyperemesis gravidarum activity.<sup>1</sup>

## Pharmacological and medicinal properties

### Antiulcer activity

*In vitro* studies of methanol extract of ginger with an MIC of 25 $\mu$ g/mL inhibit *Helicobacter pylori*. Since *Helicobacter pylori* causes peptic ulcer, ginger has an anti-ulcer activity.<sup>1</sup> Ginger Essential Oil reduced the gastric ulcer in rat stomach that is confirmed on histopathology of the stomach. Moreover, oxidative stress produced by the ethanol was found to be significantly reduced by Ginger Essential Oil.<sup>8</sup>

## Antimutagenic activity

Ginger root extract and its main polyphenolic constituent show antimutagenic activity in several cell types by inhibition of transcription factor NF- $\kappa$ B.<sup>3</sup> *In vitro* studies on ginger extract and 6-gingerol shows that 6-gingerol is more active than ginger extract in antimutagenic potential, and it does so by affecting YYT cancer cell proliferation, on MSI endothelial cell proliferation and through inhibiting angiogenesis.<sup>2</sup> Essential oil of ginger inhibited mutagenicity caused by direct acting mutagens in a dose-dependent manner. Animal model studies and *in vitro* studies on ginger essential oil shows that it inhibit mutagens by inhibiting enzymes that are involved in the conversion of mutagens into active carcinogenic forms. It also involves the increased production of enzymes that are involved in detoxification of pathways of carcinogenic compounds.<sup>7</sup> Fresh ginger extract is harmless to normal skin fibroblast viability, but caused marked cytotoxic effects on amelanotic melanoma.<sup>9</sup>

## Antimicrobial activity

Ginger extract exerts the antibiotic effects against three prominent mastitis causing bacteria in concentration dependent manner.<sup>5</sup> *In vitro* studies evaluate the antifungal activity of ethanolic extract of ginger as well as the antifungal activity of ethanol. There was an increased inhibition zone with ethanolic extract of ginger as compared to ethanol alone.<sup>4</sup> *Zingiber Officinale* as an auxiliary chemical substance and as an intra-canal medication was effective on different micro-organisms as *Enterococcus faecalis*, *Candida albicans* and *Escherichia coli*, yet was unable to eliminate the endotoxins in case of infected root canal.<sup>10</sup>

## Fertility enhancer

Ginger exerts a beneficial effect on the reproductive system of male rats. It causes increased sperm count, motility enhancing activity and testosterone while decreased malondialdehyde level. These all parameters improve the fertility capacity of semen.<sup>6</sup> Gentamycin handles the reduction of sperm count and also causes apoptosis in testis. The ginger extract showed inhibition of toxic effects of gentamycin on the reproductive system and also reduce apoptosis in testes.<sup>11</sup>

## Conclusion

The broad spectrum actions of ginger showed the antifungal activity, antibiotic activity, anticarcinogenic activity, anti-ulcer activity and fertility enhancing activity. However, further studies are required for the development of ginger as a therapeutic tool in these diseases, especially in cancerous conditions.

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None

## Conflict of interest

Authors declare that they have no conflict of interests.

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